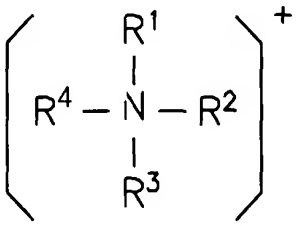
CLAIMS

What is claimed is:

1. An electrolyte for use in a lithium secondary battery, comprising an alkyl ammonium salt having a cation the following Formula 1, a lithium salt, and an organic solvent:

Formula 1



wherein R^1 to R^4 are independently a C_1 to C_6 alkyl, a C_2 to C_6 alkenyl, or substituents thereof.

2. The electrolyte of claim 1, wherein the alkyl ammonium salt includes a tetraalkyl ammonium cation or a substituted tetraethyl ammonium cation.

3. The electrolyte of claim 2, wherein the tetraalkyl ammonium cation is selected from the group consisting of a tetraethyl ammonium cation (TEA^+), a tetrabutyl ammonium cation (TBA^+), and a tetrahexyl ammonium cation (THA^+)

4. The electrolyte of claim 1, wherein an anion to be linked with the cation is at least one selected from the group consisting of bis(perfluoroethylsulfonyl)imide ($N(C_2F_5SO_2)_2^-$, Beti), bis(trifluoromethylsulfonyl)imide ($N(CF_3SO_2)_2^-$, Im), tris(trifluoromethylsulfonyl)methide ($C(CF_3SO_2)_2^-$, Me), trifluoromethane sulfonimide, trifluoromethylsulfonimide, trifluoromethylsulfonate, AsF_9^-, ClO_4^-, PF_6^-, and BF_4^-.

5. The electrolyte of claim 1, wherein the concentration of the alkyl ammonium salt is 0.1 M to 0.8 M.

6. The electrolyte of claim 1, wherein the amount of the alkyl ammonium salt used is 1 to 15 wt % on the basis of the total electrolyte.

7. The electrolyte of claim 1, wherein the lithium salt includes at least one of: $LiPF_6$, $LiBF_4$, $LiSbF_6$, $LiAsF_6$, $LiClO_4$, $LiCF_3SO_3$, $Li(CF_3SO_2)_2N$, $LiC_4F_9SO_3$, $LiSbF_6$, $LiAlO_4$, $LiAlCl_4$, $LiN(C_xF_{2x+1}SO_2)(C_yF_{2y+1}SO_2)$ (where x and y are natural numbers), LiCl, and LiI.

8. The electrolyte of claim 1, wherein the concentration of the lithium salt is 0.1 M to 2 M.

9. The electrolyte of claim 1, wherein the alkyl ammonium salt and the lithium salt are in a mole ratio of 1:9 to 2:8.

10. The electrolyte of claim 1, wherein the organic solvent includes at least one of dimethoxy ethane, dioxolane, and mixtures thereof.

11. The electrolyte of claim 1, wherein the amount of the organic solvent used is 70 to 98% by volume of the total electrolyte.

12. The electrolyte of claim 1, wherein the organic solvent comprises at least two groups selected from a weak polar solvent group, a strong polar solvent group, and a lithium-protecting solvent group.

13. The electrolyte of claim 12, wherein:

the weak polar solvent is selected from an aryl compound, a bicyclic ether, and an acyclic carbonate;

the strong polar solvent is selected from a bicyclic carbonate compound, a sulfoxide compound, a lactone compound, a ketone compound, an ester compound, a sulfate compound, and a sulfite compound; and

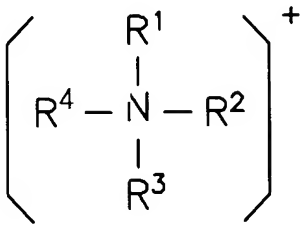
the lithium-protecting solvent is selected from a saturated ether compound, an unsaturated ether compound, a heterocyclic compound including N, O, and S, and a combination thereof.

14. The electrolyte of claim 1, wherein the electrolyte is used in a lithium-sulfur battery.

15. A lithium secondary battery comprising an electrolyte which includes an alkyl

ammonium salt having a cation of the following Formula 1, a lithium salt, and an organic solvent:

Formula 1



wherein R^1 to R^4 are independently a C_1 to C_6 alkyl, a C_2 to C_6 alkenyl, or substituents thereof.

16. The lithium secondary battery of claim 15, wherein the battery is a lithium-sulfur battery.